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User Acceptance of Real-Life Personalized Coaching in Social Fitness Apps

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ABSTRACT

This exploratory study contributes with in-depth insights into the user acceptance of real-life personalized coaching in social fitness smartphone apps. We have defined a set of novel coaching concepts, where a dyad with strong social ties perform real-life exercises, set and track the progress of shared fitness goals. To gain a user-centred context, we have adopted a mixed-methods design and conducted a twofold experiment. First, we have participated in survey where 1530 participants shared their views on the proposed coaching concepts. Second, we have developed a prototype social fitness app and have conducted a small pilot study to learn from the participants' first-hand experience. Our findings highlight a number of approaches for enhancing coaching-based social fitness apps. We identify target groups that clearly show interest towards the presented coaching concepts. We report on user preferences towards taking a particular user role. We discuss the user experiences with the pilot app, and we pinpoint set of user barriers for using apps based on personalized coaching.

CCS CONCEPTS

•Applied Computing → Health Informatics; •Human-centered computing → User studies; Usability testing; *Smartphones; Ubiquitous and mobile computing design and evaluation methods;*

KEYWORDS

mHealth, social fitness apps, user acceptance, personal coach

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1 INTRODUCTION

Physical inactivity is a major health issue affecting all population groups. With the advance of technology, mobile health paves the way towards development and implementation of innovative methods for tackling this worldwide problem. The smartphones' pervasive nature offers the advantage of designing health interventions available anytime and everywhere. App-based health interventions gain much attention among developers, given the worldwide popularity of smartphones, with apps being widely used and easy to reach, in addition to offering cost-efficient interventions.

Social fitness apps are rooted in social connections between users, and revolve around the concepts of social influence, mostly through social support and competition. Numerous social fitness apps are developed in order to encourage physical activity (PA), as summarized in Section 2. However, designing useful and effective (social fitness) apps is a considerable challenge. Previous research have raised concerns on the way fitness apps are designed, with most of them lacking evidence-based methods and not following medical (health) guidance [16, 19]. Furthermore, introducing novel features in apps is usually followed with a high risk of app dropout [8]. Therefore, conducting acceptance studies among the potential users can be crucial for the app' success and effectiveness. Systematic reviews and meta analyses on the effect of fitness apps for increasing PA agree that there is an absence of larger-sample studies [4, 11]. Consequently, it is challenging to discuss the validity and reliability of thereby developed systems.

In this paper, we present an exploratory study on user acceptance of novel personalized coaching methods in social fitness apps.

We evaluate the benefits of applying personalized coaching concepts in social fitness apps, tailored towards the needs of insufficiently active people (inactives). The majority of the available (social) fitness apps on the market are developed to facilitate PA particularly for already active people [21]. Inactives, on the other hand, might have different needs to get involved with fitness apps as already reported by [30].

Furthermore, we argue that the potential of personalized coaching in social fitness apps is relatively under-examined. Inactives might especially benefit from having supportive social environments and being part of a buddy system, in particular in order to overcome their initial barriers towards PA [10, 30]. We propose a coach-coachee relationship, where an inactive (coachee) has a personal coach (motivator) coming from its close social ties. This is

unlike most available commercial fitness apps that offer the support of a professional, but often costly and unaffordable, coach.

Our final motivation is to test the potential of social accountability as a main building block of the proposed coach-coachee communication. Social accountability refers to "a person's awareness of another person's goal and rendering himself/herself responsible to the goal's successful fulfillment" [7]. Social accountability is already implemented in commercial apps to help users achieve goals , but its potential in social fitness apps is rather unexplored. We propose personal coaching via social accountability, where the coach observes the (jointly set) goal progress of the coachee.

This study focuses on the *user acceptance* of the above introduced, real-life personalized coaching concepts in social fitness apps. We aim to:

(1) identify potential target groups interested in using social fitness apps based on real-life personalized coaching
(2) understand the user's preferences (and expectations) towards taking a particular role of a coach and/or coachee in an social fitness app
(3) identify potential barriers towards using social fitness apps based on real-life personalized coaching

We investigate these questions by performing two-fold mix-method study. First, we have been able to join a nationwide sports survey, in which 1530 participants gave their opinion on the proposed coaching concepts. This gave us the opportunity to investigate our research questions on a large-scale population level, defining several user categorizations regarding age, education level or yearly sport participation. The second part of our study is where theory is put to practice. We have developed a prototype social fitness app based on the discussed coaching concepts and tested the user acceptance in a small pilot study.

This study's strength is in the link between the two methods, the 'theoretical' survey and the 'practical' prototype app, enabling us to discuss different dimensions to answer our main research objectives. We perform both qualitative and quantitative data analysis on the collected data. The outcomes of the data analysis give us a basis for a fruitful discussion on user acceptance of real-life personalized coaching social fitness apps. This exploitative study offers a set of helpful insights on understanding user preferences and detecting potential target groups, to both the pervasive health community and the developers of social fitness apps.

The remainder of this paper is organized as follows. The next section gives more background on the previously developed social fitness apps and most common social features these apps contain. In Section 3 we detailedly describe the methodology behind this exploratory study. Section 4 reports on the outcomes of the conducted analysis. The paper concludes with a discussion on the user acceptance of the proposed coaching concepts in Section 5.

2 BACKGROUND

This section gives an overview of previously developed social fitness apps. We review the common app features and consider the user concerns related to data privacy. Furthermore, we discuss observational learning and social accountability as additional useful techniques in social fitness apps. The outcomes of the reviewed studies firmly indicate that social fitness apps can be both effective and well accepted by users. However, they also suggest that the app acceptability can be affected by the way the social features are designed. This implies the necessity of a careful design process and testing of the newly developed apps in both large and small scale evaluation studies.

Common features in social fitness apss

Team-based social features are the foundation of many social fitness apps [5, 6, 14, 17]. Social interaction is identified as an essential element for designing fitness apps [5, 29]. Incorporating social features like peer-to-peer influence, competition or cooperation can be beneficial for improving users' PA [1]. The user study presented in [6] has investigated the effects of social incentives on PA. They have developed an gamification-enhanced app, in order to understand how dyads (a team composed of two people) interact in different settings, namely cooperation, competition and hybrid. Exercising together outperformed exercising alone by 15%. Moreover, they have found cooperation as the most effective dyad communication strategy (21% PA increase), compared to the hybrid (18% PA increase) or competition (8% PA increase). In the Fish'n'Steps gamification-based app [17] the authors rely on group responsibility in order to motivate users to perform better. Similarly to [6] they use both cooperation and competition strategies. They conclude that encouraging users who fail to perform is more efficient than negative reinforcement for long-term behavioural change. Using social competition in social fitness apps have shown mixed efficiency results in another previous research. Social competition is the main component of the Mobile Lifestyle Coach app [14]. The researchers have divided the participants in two groups, the first being part of a team and the second group exercising individually. The app showed both the individual and team goal progress, along with the progress of the other participating teams. The results indicated that the users being part of a team were not superior compared to users who participated individually. This is confirmed by [10, 17], that in addition showed how competition elements can be negatively perceived by some users. Along the line of the presented past research experiences, we base our coach-coachee communication on cooperation, instead of competition features.

PA data privacy

Social fitness apps frequently rely on sharing PA data between peers, and few qualitative studies have confirmed sharing PA data as effective strategy for motivation [5]. The Houston app presented in [10], is built upon social support for becoming more physically active. Users can share their daily step counts within groups and encourage themselves via textual messages. The PA data can be shared with all other users, a subset of users or none. The results indicated that social support was effective, as users who reached their daily goals were mostly those who shared their steps with others. However, users who did not meet their goals considered sharing as displeasing. Many commercial apps like Runtastic or Nike+ have the option of sharing PA data on social media, although users have already expressed their mistrust about sharing online [22]. Since privacy issues are an considerable obstacle to indulge users in apps, a safer alternative is considered in our research: sharing PA data within participants' strong social ties.

Observational Learning & Social Accountability

Besides motivating users via social support, cooperation or competition, mobile app developers can rely on observational learning and peer modeling techniques, that can be achieved by exercising with others in real-life and observing their behavior. Observational learning was already shown useful in order to build positive social norms related to PA [26]. Involving social learning strategies can be a key factor for successful behavioural change [2]. These strategies involve sharing exercise tips or giving pointers to health-related assets. In our research, we apply observational learning by means of real-life personalized coaching, where the coach and coachee indulge in real-life joint exercise sessions.

Social accountability has been used in commercial products like CommitTo3 and GoalSponsor [9, 15]. In CommitTo3, the users build social accountability groups to motivate themselves in fulfilling three arbitrary daily goals (not necessarily health related). The users share their goals within their group and are able to track their team members' progress. Similarly, in the GoalSponsor app the users appoint their own accountability buddy with whom they monitor and share the progress. Social accountability is already introduced in research-based fitness apps as well. In the HealthyTogether project[7], mutual accountability is explored in a gamification-based app. The users who were in teams based on social accountability, improved their PA by 15% compared to those who were not. However unlike what we propose, this study does not use social accountability as a foundation for real-life personalized coaching.

3 METHODS

In this section we describe the context in which the user acceptance study was organized. Two-fold mix-method study was conducted to investigate the acceptance of real-life personalized coaching in social fitness apps. We explain the methodology behind the nationwide survey and the pilot study. Finally, we present the aim and the research procedure of the forthcoming data analysis.

NSR Survey

We joined in with the Dutch National Sport Research (NSR) survey, an initiative by the Mulier Institute (a non-profit scientific sport-research institute in the Netherlands). The fieldwork was performed by the national research agencies during March 2018. A questionnaire on various sport-related topics was shared among 1530 participants of the survey.

The users were categorized based on their gender, age, educational level and yearly participation in sports, following the standards implied by NSR. A statistical summary of the participating sample and more details on the user categorization are presented in Table 1. We have contributed four questions to the NSR survey, based on our predefined research goals. The exact set of questions are presented below.

(1) **Question1** Researchers from the VU Amsterdam have created an app for smartphones to encourage people to do sports and to be involved in physical activity. The app uses social support to be active together. This brings together two people who know each other such as family, friends or partners. The goal is to motivate each other to become active and to communicate with each other. In each team, someone has the task of acting as a personal motivator and coach for the other team member. The coach advises, gives tips and motivates the other team member to do sports or to involve in physical activity. The app keeps track of the amount of physical activity of both. This information is visible to the pair. Furthermore, it is possible to set goals and to chat via the app. The pairs can undertake exercise activities together, but also individually. How attractive do you think such an app is?

The provided options are: Very attractive / very unattractive (5 point scale)

(2) **Question2** Can you explain this answer? (text only)

(3) **Question3** If you were offered this app, what role would you like to play?

The provided options are: I would like to act as a coach; I would like to be coached; I would like to both coach and be coached; Neither; Not applicable, I don't have a smartphone.

(4) **Question4** Suppose you install this app on your smartphone because you want to be more active. From whom would you like advice to exercise and to receive motivation on the app?

The provided options are: Only advice from my team member (generated by my other team member); Only advice at specific moments of the app itself (generated by the app, smart algorithms); Both through my team member and via the app; Neither.

Table 1: NRS Survey participants statistical summary

Gender	
Female	*n*=720 (46%)
Male	*n*=810 (54%)
Age Group	
16 - 20 years	*n*=85 (6%)
21 - 35 years	*n*=286 (19%)
36 - 50 years	*n*=378 (25%)
51 - 65 years	*n*=455 (30%)
66 - 80 years	*n*=326 (20%)
Educational Level	
Low	*n*=492 (32%)
Middle	*n*=665 (44%)
High	*n*=373 (24%)
Exercise Frequency (past 12 months)	
0 exercises	*n*=398 (26%)
1 - 11 exercises	*n*=123 (8%)
12 - 59 exercises	*n*=464 (30%)
60 - 119 exercises	*n*=276 (18%)
120 or more exercises	*n*=269 (18%)
Sport Association Membership	
No	*n*=458 (30%)
Yes	*n*=1072 (70%)

Social Coaching app Pilot Study

The *Social Coaching app* was designed in order to evaluate the user acceptance of a social fitness app based on personalized coaching and to learn from users' first-hand experience. We designed the app following guidances defined by [30] for developing fitness apps based on the needs of inactives. Below we give details on the app's main functionalities. In addition, we explain the experimental procedure for the pilot study.

Design. This Android-based app enables dyads (team of two people) with strong personal ties, to perform real-life exercises, set joint goals and track the progress of the goal fulfillment. The dyad is composed by a motivator (coach), that observes and motivates the inactive (coachee) in becoming more physically active. The role of the motivator is to support and stimulate the inactive to increase its physical activity, both via the app and in person. The coachee is accountable to perform according to the plan, as the progress is continuously observed by the motivator.

The *Social Coaching app* serves as a platform where a dyad can communicate with each other. The app has a chat function to facilitate communication. Moreover, we have implemented a motivational board that is shown on the inactive's app screen. The motivator is encouraged to send (daily) supportive messages to it's coachee, and these quotes are then showned on the inactive's motivational board.

Dyads indulge in joint exercises especially in order to benefit the effects of observational learning. The app tracks walking and running activities as relatively simple and low threshold healthy activities, especially suited for inactives. During the exercise session the motivator can observe the exercise progress of the coachee on the smartphone's screen. We have used the SWAN open source sensor framework [28], to manage the accelerometer sensor data processing during the exercises. Walking and running activities are tracked and derived by using an open-source accelerometer-based step counter algorithm [13]. The participants are also encouraged to exercise individually, if a joint session is not possible.

The dyad is responsible for (weekly) walk/run goal setting, and scheduling the joint exercise sessions. The goals are dependent on the inactive's capabilities and should be set together with the coach. The app enables goal monitoring and history stats overview of performed exercises. The same goal and stats information is shown on both team members' screens.

To obtain continuous objective measurement of the individual user's physical activity, as needed for our further research analysis, participants were provided with a Fitbit One. Therefore, in addition to the built-in functionalities, the app connects and displays each user's own Fitbit steps data. Each participant was additionally requested to manually insert any other exercise (besides walking and running) that was performed during the week.

The app went through several design evaluations - Figure 1 shows screen shots of the final design product. More details regarding the design implementations, the used technology and the followed guidances for developing the app are explained in our previous paper [25].

Procedure. A five week pilot study was organized to test the *Social Coaching app* , with 10 participants (5 male, 5 female) organized in 5 dyads. Most of the participants were employees at Utrecht Municipality, all dyads formed based on previous social ties: three dyads were based on their work relation, while two dyads were based on family relation. The dyads were composed by one physically active person (coach/motivator) and one inactive person (coachee/inactive), as subjectively assessed by the participants. All participants were required to fill in an on-line intake questionnaire, with questions regarding demographics, education, personal communication frequency with teammate, perceptions regarding physical activity, using apps for health and fitness. After the intake, the participants received a Fitbit One, and were given instructions on how to use the activity tracker, how to install the *Social Coaching app* and synchronize their Fitbit's data in the app.

The study included one week assessment period, followed by a 4 week intervention period. The assessment week was used to assess the physical activity levels of each participant. Each participant was requested to manually log (in the app) all the exercises performed during 7 days (in addition to the Fitbit that tracks only step-based activities). The assessment period allowed us to objectively determine the assigned user roles: motivator and inactive. Afterwards, the dyads were confirmed and the participants entered the four weeks intervention period of personalized coaching via the *Social Coaching app* . At the end of the experiment, the participants received a link to the final questionnaire, containing (among others) questions regarding the acceptance of the personalized coaching concepts introduced in the app. Moreover, at the end of the study we have conducted a post-study semi-structured interview with each participant. During the interview, we asked the participants to share their experience with the experiment and using the app, explain the reasons of not (frequently) using the app, the Fitbit experience along with the app, their expectations regarding their user role and their opinion on the proposed real-life personalized coaching concepts. The interviews were audio-recorded and transcribed.

Data Analysis

The multidimensionality of the collected data coming from both the NSR survey and the *Social Coaching app* user study, allows us to test the acceptance of the proposed coaching concepts from multiple perspectives. We perform both quantitative and qualitative analysis on the obtained data. The survey's quantitative data analysis enables us to look at user acceptance on population level. We examine the varieties of acceptance comparing age groups, gender and yearly participation in physical activities. In addition, the second survey question yielded an interesting qualitative analysis, as users could freely express their view on the proposed concepts. The *Social Coaching app* is where theory is put into practice. We use the end-of-experiment online questionnaires to quantify the users' experiences on real-life personalized coaching via a mobile app, and test the acceptance of several alternative coaching techniques. Furthermore, the post-study audio interviews facilitate the qualitative analysis, where we focus on first-hand user experience on using the *Social Coaching app* .

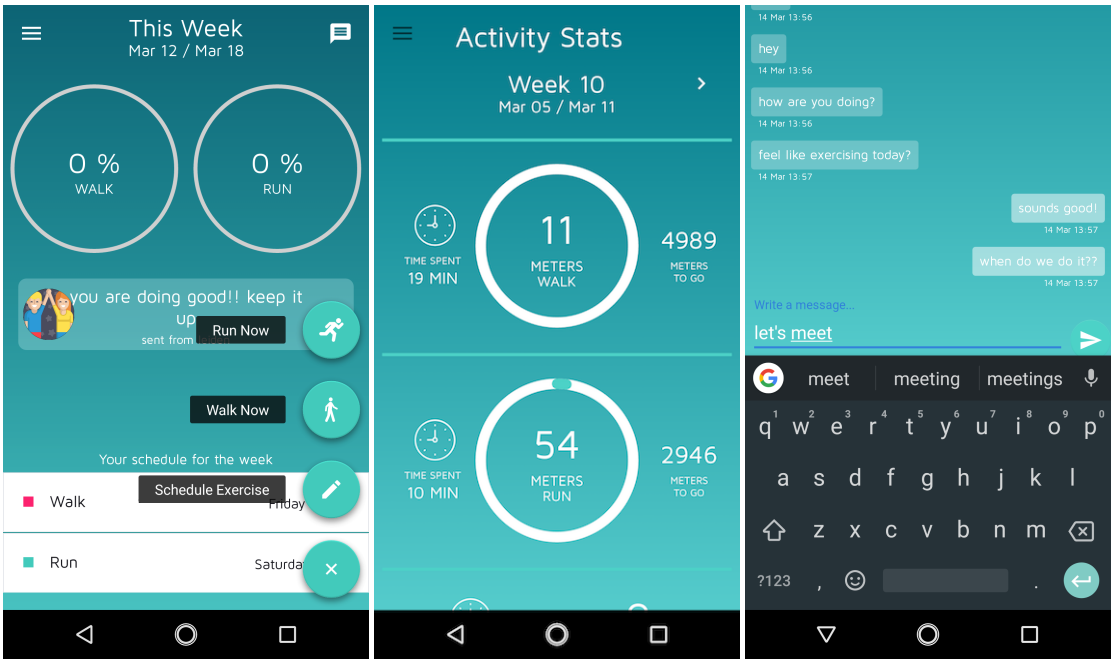

Figure 1: *Social Coaching app* screenshots. The left figure shows the home screen - the weekly goal progress is displayed with two pie charts, followed by the motivational board and the exercise schedule for the current week. The central figure shows the activity stats, based on the walking and running accomplishments (in number of meters and time of exercising) during the week. The figure on the right visualizes the chat functionality.

4 FINDINGS

In this section we present our analysis of the user acceptance of the proposed coaching concepts, from both the NSR survey and the *Social Coaching app* pilot study. We discuss the findings based on the quantitative and qualitative analysis of the collected data.

NSR Survey

Quantitative Analysis. The presented results are based on the NSR survey outcomes of Question1, Question3 and Question4. As previously discussed, the participants were categorized based on several metrics. For this analysis, we defined the following user categories: age, educational level and exercise frequency in the past 12 months. A complete statistics of the survey responses is available on request.

Figure 2 gives a visual summary of the NSR survey results. Each row represents a particular user category, while the columns represent the three survey questions: Question1, Question3 and Question4, respectively.

We have performed chi-squared tests on the answer-based distributions. Each bar plot of Figure 2 was considered as an separate distribution, and the chi-squared test was performed on every pair of distributions belonging to the same question and user category. This approach was used in order to test the statistical difference between the distributions. Statistically significant difference (p <0.05) was found at 35 pairs of distributions, as depicted by the arrow lines (and the corresponding p-value) in Figure 2. For example, the fourth square (*Question1*, age groups) illustrates that statistically significant difference was found between four distribution sets: 16-20 and 51-65; 16-20 and 66-80; 21-35 and 51-65; and 21-53 and 66-80 age groups.

In Question1, the participants were asked about their opinion on using a social fitness app based on the defined personalized coaching concepts. Based on the survey' exercise frequency (e_freq) user categorization, we identify two groups of inactives among the participants, namely users that do not indulge in any sporting activities (e_freq = 0), and users that rarely do any physical activities (1 <e_freq <11). As can be seen in Figure 2 these two answer-based distributions are statistically different ($p = 7e - 05$). There is a striking contrast in both groups' standpoint towards the proposed coaching concepts: while the e_freq = 0 group is most skeptical user group towards the presented ideas, the second group shows highest support towards the coaching concepts. Users that lack any exercise routine (e_freq = 0) are also most reluctant towards the proposed coaching concepts, with 32% of them finding the idea very unattractive (16%) or unattractive (another 16%). On the other hand, (1 <e_freq <11) group's interest in using the presented app surpasses all other user groups, with 31% of participants considering the idea as attractive (25%) or very attractive (6%). The interest in the coaching concepts drops with age. Among the youth (16-20 years old) 33% consider the proposed coaching app (very) attractive, compared with 14% of the elderly (66-80 years old). The chi-squared tests revealed that statistical difference exists between the youth-age distributions (12-20,21-35) and the older-age (51-65 and 66-80) distributions, regarding the answers of *Question1*.

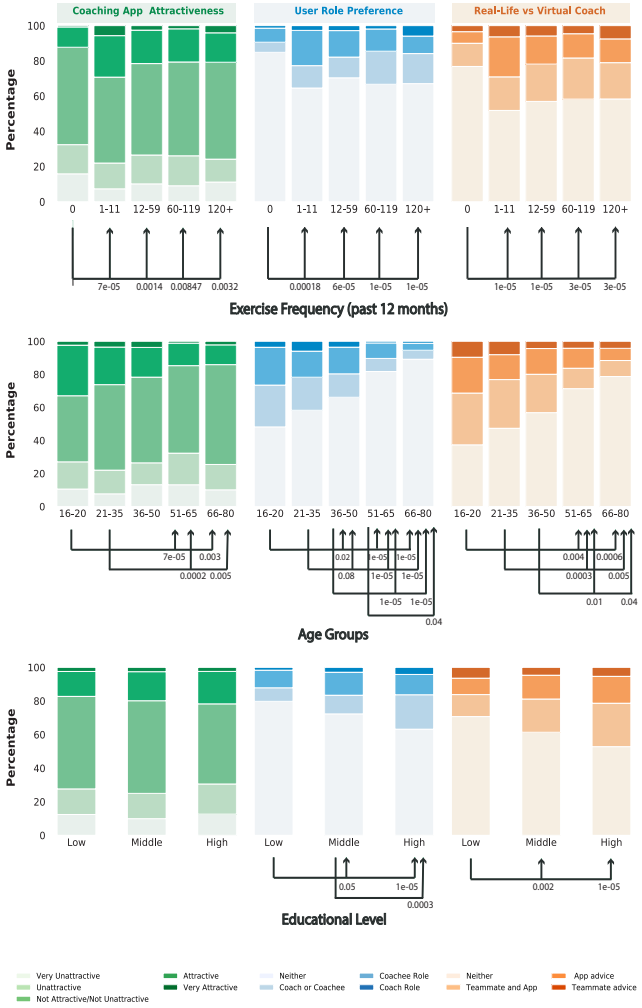

Figure 2: NSR survey outcomes related to user acceptance of the proposed coaching concepts in social fitness apps. The stacked bar plots show the percentage of an selected option of a particular survey question. The rows depict different user categories: exercise frequency, age groups and education level. Each column represent the survey outcome for a particular question, as follows: user acceptance of personalized coaching concepts in social fitness apps (green), user role preference (blue), real-life vs virtual coach preference (orange). The arrow lines illustrate the distribution pairs where statistically significant difference was determined following the chi-squared tests.

Based on Question3, we analyze the participants' preference on taking a particular user role in coaching-based social fitness apps. Generally, it can be observed that there is a considerably higher interest in being coached than to take the role of a coach. The combination of both being a coach and be coached, is still very much more attractive, compared to the sole coach role. Once more, the users who do not exercise ($e\_freq = 0$), prefer not to take any role in a coaching app, as reported by 74% of this user group. The interest in taking a user role declines with age: yet again, the youth shows largest interest in having the role of a coach (4%), being coached (23%) or a combination of both (25%). Noticeably, the acceptance of a user role grows with the level of education. While 33% of low educated participants are willing to take either a coach or coachee role, this number increases to 41% at the highly educated population. The chi-squared tests confirm the statistical difference between all pairs of the answer-based distributions: $p = 0.04748$ for the *(low,middle)* pair, $p = 1e-05$ for the *(low,high)* pair, and $p = 0.00035$ for the *(middle,high)* pair.

Lastly in Question4, we look at users' preference in having a virtual coach (based on the app's smart algorithms) against having a real-life coach (teammate). It is noteworthy to mention that on the whole, participants tend to prefer a combination of real-life and virtual coach for support and advice, followed by just an virtual coach, while the acceptance of only real-life coach does not surpass 10% for any user category. Similar patterns among the particular user categories prevail for this question too. Inactive participants exhibit least interest in getting advice about physical activity from either a real-life coach or a virtual coach. The younger generation are substantially open towards coaching from (either) real person and virtual system, with 63% of youth aged 16 to 20 and 52% of the millennial generation between 21 - 35, being positive about the potential coaching. Lower educated people, with 68% are more hesitant towards accepting advice about physical activity via an app (regardless of real vs virtual coach), compared to 51% of higher educated people.

Qualitative Analysis. We base the NSR survey qualitative analysis on Question2 responses. In this question the NSR participants were asked to textually clarify their selection on Question1. We have received total of 1214 open answers, out of which only a fraction was used- we have filtered out the responses containing less than 100 characters, to ensure the quality of the presented analysis. In total, 125 responses fitted the requirements for our analysis, distributed as 5, 16, 54, 28 and 22, for the scale of Very Attractive to Very Unattractive, respectively. We present a general overview of the frequently mentioned (dis)liked aspects on the proposed coaching concepts. We continue by showing several selected responses based on their relevance and importance for future design initiatives.

Involvement with other people in exercises was one of the reasons why people liked the presented coaching concepts. Sporting together was considered more simulating and giving extra motivation, especially when self-discipline is lacking. Some people reported that they feel more comfort and relaxed when exercising together. Others liked exercising together as it increases the social pressure and helps to turn intentions into actions. On the other hand, the most often reported drawbacks were related to the use of an app for replacing human-to-human contact and receiving motivation through a smartphone. Some participants identified apps as too pushy, and requiring even more interaction with their phone. User privacy issues regarding storing the data in the cloud was also mentioned by several participants. The participants that preferred individual exercises, have identified connecting and planning exercises with others as bothersome.

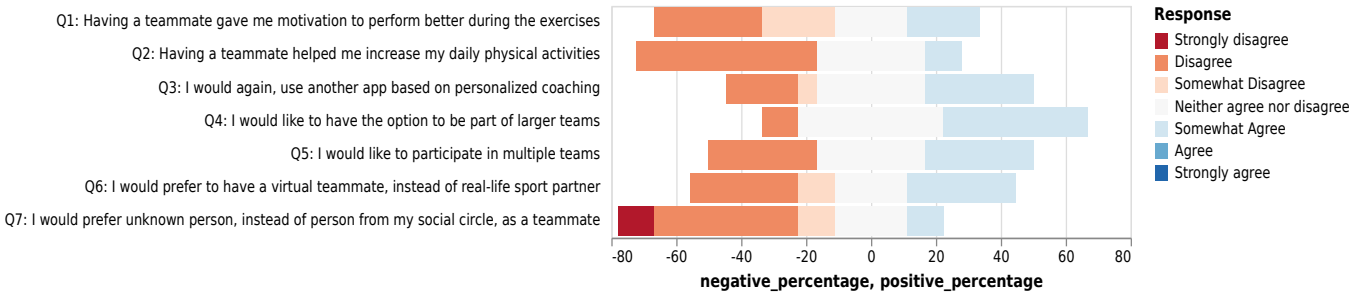

Figure 3: The diverging stacked bar plots represent the questionnaire outcomes related to the pilot study participants' acceptance of the coaching concepts (and proposed alternatives). The exact questions are displayed on the y-axis, while the x-axis represents the user's opinion (in percentages) on those topics based on a 7 point Likert scale.

Evidently, there is a detachment between users in two leading groups: those who are fond of exercising together as opposed to those who prefer individual sporting. One participant comments (all comments translated from Dutch language): *"I need incentive to sport, e.g. walking with somebody. I have looked for such a long time to walk together, alas. If you have such an app then you can solve this a bit."* Being part of the team is acknowledged by another potential user: *"You keep each other busy, you feel guilty if the other person will go sporting, so you will go as well, and the other way around. You help each other, sporting together is also nicer than alone."* Taking the first step towards being more active using apps was also recognized: *"Almost everyone has plans to exercise. But especially the step from the bank to the front door is a big one that is largely taken away in this way."* Most of the neutral responses are from users who have an individualistic approach towards exercising but recognize these concepts as useful for others. As mentioned here: *"I'm in my own rhythm and that is good. To stimulate each other in the old-fashioned way, I think OK. At age 70 there is not so much need for modern changes."* or by another participant: *"I am fairly independent and I can motivate myself, but I can imagine that someone else can benefit from it"*. Planning to do exercise with others can be a significant disadvantage for some participants: *"I would like to keep control of my exercise moments. Others do not have to interfere."* and an obligation: *"I want to sport according to my own planning: with somebody else is will become a obligation."* Another group of participants were more pessimistic towards the proposed app. As reported by one person: *"There are already thousands of apps to track activities and share them with a friend or the whole world; I'm not waiting for a new one."*

An app was considered as unnecessary when connecting people with mutual strong social ties, as mentioned here: *"If you already know each other, I think this is really nonsense ... and you can also discuss it with each other to work out"* and the social concepts were diminished: *"I find the social aspect of sport horrible. I prefer to exercise alone without interference from others. And do not need an app. Can be done just face to face."*.

Prototype App Pilot Study

Quantitative Analysis. The pilot study's quantitative analysis is based on the end-of-experiment online questionnaire that was shared among the pilot study participants. The questionnaire contained a set of topics related to user appreciation of the *Social Coaching app* (satisfaction, user friendliness, effectiveness and professionalism), technical problems, likability of app features, and user acceptance and experience with the app's coaching concepts. The latter category is of interest for this analysis. The questions on user acceptance of the coaching concepts were answered on a 7-point Likert scale, and are defined as shown in Figure 3.

Nine participants (out of 10) have answered the questionnaire (5 female/4 male, aged 19-55, 41.5 average age). Five of them have had a previous experience with fitness apps, and three of them have used an activity tracker before the experiment.

The first three questions are directly related to user's experience with their teammates while using the *Social Coaching app* . We were interested to know if having a teammate help the user perform better while exercising (Q1) and helped to increase its daily physical activities (Q2). In general the user experience is neutral towards negative, regarding both questions. 22% of the participants somewhat agree that having a teammate was motivating for better performance (compared to 11% sharing the same view on Q2). A big number of participants (44%) disagree that having a teammate was helpful for increasing daily physical activity. On the positive side, only 33% had negative thoughts on installing another app, next to apps they already use, that is based on personalized coaching (Q3).

The following four questions are related to alternative coaching strategies that might be tested in the upcoming app' design iterations. The participants were somewhat positive (44%) towards the idea to be part of bigger (more than 2 member) teams (Q4). Participating in several teams (Q5) was generally perceived more negative, with 33% disagreeing with this idea compared to 11% for Q4. Finally, we asked about participants' preference of having a virtual coach (Q6) or unknown person (Q7) as a teammate. These alternatives were somewhat approved by 22% (for Q6) and 11% (Q7) of the participants. The participants were more negative towards the idea of having an unknown person as a teammate, with 11% strongly disagreeing with this concept.

Qualitative Analysis. The audio-interviews transcripts were used for the qualitative analysis of user's experiences with the *Social Coaching app* . A set of precoded questions were asked to the participants, related to personalized coaching, barriers towards coaching,

expectation of user roles and ideas about alternative coaching strategies. For better readability the participants are labeled as P1-P10, in the remainder of this analysis.

The aim of the *Social Coaching app* is to offer personalized coaching mostly through performing real-life dyad exercises and motivation. However, time and organizational matters were acknowledged as considerable barriers towards performing joint exercises. For example, P1 reported: *"I live in X, P2 lives in Y, so it was complicated to organize real-life exercise sessions. I thought the idea was to have online (via the app) style of coaching. If I knew it at the beginning then I wouldn't even join."*

Planning to organize real-life joint exercises is identified as another barrier, as reported by P8: *"Planning is really difficult, so sometimes you can only plan half hour. I would leave out the planning part and just try to get the goal of 10000 steps or more."* P6 also said: *"We do not live in the same place. In our case we try to plan a lunch walk, that would work I think."*. His coachee, P5 added on that: *"Maybe is more interesting to see someone after work or in your private space to exercise. I am really busy at work so I don't plan walks during work..."* Performing joint exercises, is also a matter of learning habits. As P3 comment: *"We are not used to do something (exercises) together, its better to just keep track of each other."*

There were reported ambiguities about understanding the coach role in the app, as P1 indicated: *"I thought my role would be only to speak with my coachee. I didn't even expect to have my own Fitbit, nor I am the one who is interested into my own activities."* Another motivator, P6, had a comparable comment on the coach role: *"I am trying to coach her, and as I said it not necessary to have my own data displayed on the phone, I guess. I would like to see the data from the Fitbit of my coachee."*

Some of the participants deviated their communication with the teammates 'offline', as the app itself didn't give incentives for continuous use. For example, P3 said: *"It was nice experience with the Fitbit, and the concept of social coaching, I think that was quite a good idea. We did it, in a kind of offline way, but the app experience didn't really add to it."* Similar communication style was followed at another dyad, as commented by P6: *"I think at the beginning it kind of worked like that, that we talked about exercising and well I want to do this and that.. so at the beginning P5 sometimes told me what her plans were, but that faded as soon as the app didn't work as we expected."* Tips on how to perform the coach role was anticipated by P9: *" I expected to receive guidance from the app on how to be a coach."*

Lastly, we present some of the participants' suggestions for what to incorporate in the next-phase app development. Some participants wished for competitiveness elements in the app, as P3 mentions: *"It would be nice to have some competitive elements. Since that is what is happening in the real world when we meet, we are comparing like hey you have so many steps, and I have so ...So now I take stairs in order to improve.. That kind of communication side, in the app was missing."* Competition-based coaching was also suggested by P5: *"Maybe coaching from both sides is more interesting. I have a running group at home, and we have an app group and we motivate each other to go for a run together.. You have a same goal to run, and its both sides coaching. So for both sides is interesting to move."* The potential of social coaching as part of another system was mentioned by P7: *"In Fitbit you can add friends but that's quite minimal. I think it is useful addition to the Fitbit app - to have a social coach. It could give more connection to each other and you can indeed do your exercises together. So, in potential I guess it will work."*

5 DISCUSSION AND CONCLUSIONS

In this exploratory study we have examined the potential of applying real-life personalized coaching in social fitness apps. We have collected valuable data on user opinions regarding personalized coaching, from both large-scale survey and the small-scale pilot study participants. By blending their viewpoints, their suggestions and first hand experiences, we now discuss and answer the research questions defined in Section 1. Our primary interests are identifying potential target groups of users of social fitness apps, grasping understanding on the user's preferences and obstacles of taking particular user role, and pinpoint potential barriers towards adopting social fitness apps based on real-life coaching. Below we summarize the most important findings, and examine their implication for future design of coaching-based social fitness apps.

Identifying potential target groups among users

The survey's multifaceted user categorization allows us to pinpoint potential target groups interested in using social fitness apps based on personalized coaching. The inactive population, being one of the incentives for conducting this research, has shown mixed acceptance on the proposed concepts, as shown in Section 4. Based on the survey's output we recognize a big contrast in the app acceptance, comparing the ($e\_freq = 0$) group with users who do insufficient number of exercises ($1 < e\_freq < 11$). This disparity implies the potential existence of significant sub-groups among the inactive population, that are yet to be identified and characterized. Nonetheless, the rather positive feedback from the ($1 < e\_freq < 11$) group, speaks about the prospect of applying personalized coaching in social fitness apps aimed at inactives. Total 31% of this group identified the idea of real-life personalized coaching in social fitness apps as (very) attractive, adding to our confidence in the benefit of the suggested coaching concepts among inactives.

User interest in personalized coaching fitness apps declines with age. Accordingly, youth (aged 16-20) followed by the millennials (aged 21-35) can be considered as preferred target groups for social fitness app developers. These users show the highest openness towards the proposed coaching concepts. This outcome is in line with previous research reporting younger users favorability of having personalized coaching features in fitness apps [20]. The authors of [20] report that young users who do not meet the PA requirements (inactives) are particularly open towards personalized coaching ideas. Designing useful and effective social fitness apps targeted at youths is especially important, as at this transitional stage habits can be sustained into adulthood [3]. This initiate an incentive for performing a future research study: developing an social fitness app targeted at young people who hardly indulge in any fitness activities ($1 < e\_freq < 11$).

Finally, we find highly educated people as an additional target group. Our results show that highly educated participants are in general more open towards the proposed concepts, especially for taking a particular user role and receiving activity-related advice. We relate these findings with previous research on the correlation

between educational level and physical activity. Past studies have already shown that highly educated people are more aware of the importance of being physically active, and exhibit positive physical activity habits [23, 24].

User role preference

Based on the survey's output we conclude that there is a significant disproportion in user opinions on taking either the coach or the coachee role in fitness apps. In general, the ratio between coachee/coach user role acceptance is 4:1. Obviously people find more incentives in being coached by others. The reported imbalance implies that designers of coaching-based social fitness apps should propose novel methods that will motivate more people to sign up as a coach. Defining the coach role in a precise manner is also important, as we learned from the pilot study. The participant' first-hand experience with the *Social Coaching app* suggested that coaches have no expectations in seeing their PA accomplishments and want to focus on motivating their teammates, by observing their PA data and progress over time. In addition, the motivators are interested in learning how to be a coach - since most of them lack any professional coaching experience. Gamification being an effective technique for mobile apps [12, 18], can be one way of educating the social coaches. In addition, this technique can be incorporated in other elements of the app, for example gamifying the real exercise sessions.

The participants of the *Social Coaching app* user study, were neutral leaning towards negative on their experience of having a teammate for improving their PA. On the other side, the encouraging message is that they were rather positive about once again installing an app based on personalized coaching. Therefore, their unfavorable viewpoint of having a fitness teammate, can be the seen as an effect of technical problems and poor app experience, and not a disapproval of the proposed coaching concepts. Lack of knowledge of how to coach can be an additional reason for these outcomes.

Modifying several aspects of the coach - coachee relationship, should be considered in the development of future social fitness apps. First, both the survey and pilot study outcomes have reported that users expect competitive elements in the app. Therefore, adding competition-based social features for potentially increasing the dyad's motivation should be tested. Second, we consider creating a hybrid dyad relation where both team members have the role of coach and coachee, as the survey's outcomes indicate that this was the most accepted strategy by the participants. In addition, the combination of real-life coach supported by a virtual coach (based on smart app algorithms) was defined as an optimal coaching strategy by the survey's participants. With the current wave of AI developments, people expect smart applications where a virtual system (like chatbot, smart assistant) can recognize the users needs and propose suitable actions. The fact that the participants were most hesitant towards having solely a real-life coach in the app, amplifies the need of incorporating smart virtual coach in the newly developed social fitness apps. Lastly, the *Social Coaching app* pilot study's participants expressed their positive opinion on being part of larger teams. Therefore, creating groups of arbitrary number of members can be one way of testing different social context in the app.

Real-life coaching barriers in social fitness apps

Both survey and *Social Coaching app* user study participants have identified comparable obstacles related to planning for exercises and using an app for real life person-to-person motivation and coaching. Organizing joint exercise sessions is complicated mostly because of time and commuting to a particular place, in case the dyad does not live close together. People feel constrained to adapt their schedules when involved in exercise with others. Therefore, the focus of the dyad communication should be shifted towards monitoring the mutual goals and achievements via the app, and organizing exercises should feel less of an obligation. Some of the pilot study participants have moved the dyad communication 'offline' without using the app, and have relied on real-life communication and using the Fitbit. In addition, the survey participants reported the lack of benefit of the proposed system, as face-to-face communication should usually suffice.

Pilot Study limitations

The presented *Social Coaching app* pilot study comes with a set of limitations. The pilot study's results might be biased from the small sample size and the technical issues that some participants encountered with the app. This somewhat limits the conclusions that can be drawn about the user acceptance of the proposed concepts via the *Social Coaching app* . Following the small sample size we did not intend to make any statistical inferences based on the *Social Coaching app* pilot experiment. The technical issues preventing some participants from performing exercises and using the app as expected, probably influenced their satisfaction with the whole coaching experience. This could partially explain the relatively negative feedback on the proposed concepts in the pilot study.

The recruitment procedure for the next planned pilot study should involve different user categories similar to those presented in the NSR survey. A next version of the *Social Coaching app* will be revised according to the feedback and experiences that we have presented in this paper. While our current findings deliver valuable design considerations for a social fitness app, we do not quantify the effect of the proposed coaching mechanism. Therefore, in the second part of the project we aim to perform a quantitative research study, analysing the PA trends over time of using the app, and measuring the goal fulfilment ratio. Using this data we will be able to investigate whether the coaching concepts actually enhance the PA of inactive users.

Conclusion

We conclude by suggesting a set of design recommendations targeted at social fitness app developers. Among the potential target groups we point out the inactives (with some exercise experience), highly-educated and youth population as most open towards the proposed concepts. A similar social fitness app tailored towards the needs of young inactives can lead to well accepted and successful product. This paves the way towards an acceptance of significantly large quantity of users, as the estimated number of smartphone owners for 2019 is 2.71 billion users . [27]. Future studies should

investigate in more details the preferences and needs these target groups have when using fitness apps. Regarding favored user roles, the participants had a strong inclination towards taking the combined coach-coachee or solely coachee role. New approaches in order to indulge the coaches with social fitness apps need to be developed. In addition, we propose modification of the coach-coachee relation, by including a virtual coach to support the dyad in their activities, and offering competitive elements in the app. Lastly, we conclude that the dyad communication should be shifted towards goal and achievement monitoring, instead of indulging in real-life exercises.

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